JAPAN

EDICT OF GOVERNMENT

JIS B 6501 (1975) (English): Test code for performance and accuracy of wood working machinery

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The citizens of a nation must honor the laws of the land.

Fukuzawa Yukichi

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UDC 674.05.001.4

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JAPANESE INDUSTRIAL STANDARD

Test Code for Performance and Accuracy of Wood Working Machinery

JIS B 6501 —1975

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JAPANESE INDUSTRIAL STANDARD J I S

Test Code for Performance and Accuracy of Wood Working Machinery

B 6501-1975
(Reaffirmed: 1978)

1. Scope

This Japanese Industrial Standard specifies, pertaining to the wood working machinery([1]), the basic items and their testing methods (general rules for testing) commonly used in cases where tests for running performance, static accuracy, dynamic accuracy, and working accuracy of the machinery are carried out.

Note ([1]) The test methods prescribed in this standard shall be applied correspondingly to those used for wood working machines having special construction or use.

Remark: The test and inspection items for each type of wood working machines shall be selected from those given in this standard according to the aim and performance of the machine, and shall be specified in the separate standard together with the provisions of tolerances for inspections.

2. General Rules for Testing

2.1 The test shall, as a rule, be carried out in the factory where the wood working machines were manufactured.

2.2 The test shall be carried out after the wood working machine has been installed and adjusted in order to be given no influence upon the performance and accuracy required for the running of the wood working machine.

2.3 The test shall be carried out, in principle, on a completely finished machine.

2.4 The test shall be carried out on the machine in which electric motors, electric accessories, and other equipment are mounted, and lubricant, hydraulic oil, and others are appropriately filled.

2.5 The test shall be carried out, in principle, after each moving part of the machine has been run and its temperature and lubrication become stable.

2.6 The static accuracy shall be measured, in principle, under such a condition that the wood working machine is not subjected to any machining load.

2.7 When two or more methods are given for one item to be checked, one method shall be selected from among them for the test.

2.8 The measuring instruments to be used for tests and their accuracies are specified in Appendix.

Applicable Standards and Reference Standards: See page 26.

2.9 When the measuring instruments specified in Appendix are not applicable, the test may be carried out with other instruments considered to be, in accuracy, equivalent to or better than the specified instruments.

2.10 When abnormality has occurred during a test, the cause of the abnormality shall be looked for and adjustment shall be made, and then the test shall be carried out again from the beginning, in principle. However, there is no need to repeat the test the result of which is considered not to have been influenced by the adjustment of the abnormality.

2.11 For wood working machines made by the same design, the test results for the rigidity may be represented by the result obtained from the test carried out on one machine, dispensing with the tests on the other machines.

2.12 When it is difficult to test a wood working machine by testing methods specified in this standard because of its configuration, the substituting methods shall be selected from those given in the specifications of this standard.

2.13 On static accuracy test, when an actual distance of measurement is smaller than the specified value, on account of the configuration of wood working machines, the tolerance shall be calculated in proportion to a given distance. In this case, it shall be 0.005 mm when the calculated tolerance is less than 0.005 mm, unless otherwise specified.

2.14 When the result of static test is different from that of working accuracy test having the same test objective, the greater stress shall be laid on the result from the latter test.

3. Specifications of Running Tests

3.1 Test Objectives and Items Running tests are intended to test the performance required for running wood working machines, and they consist of functional test, no-load running test, load running test and rigidity test.

3.2 Functional Test Functional tests are intended to examine, by operating each moving part of a machine, the smoothness of its operation and the certainty of its function. The methods expressing test results and test items and their methods shall be as follows:

(1) Expressing Method Results shall be expressed as "good" or "bad" in function.

(2) Test Items and Methods

Item		No.	Testing method	Typical examples of application (Reference)
Main motion	Start, stop and running operation	1-11	At one suitable speed, perform start and stop operations (including braking, reversing, interrupted motion and others) repeatedly, and examine smoothness and certainty of operation.	Vertical movement of hot press plate Rotation of spindle of circular saw machine or planing and moulding machine Running of carriage
	Operation of changing speed	1-12	Change the speed and examine the smoothness of operation and the certainty of indication of control device.	Rotation of veneer lathe spindle Rotation of wood lathe spindle
Feed motion	Start, stop and running operation	1-21	Choose one suitable feed rate, perform start and stop operations (including braking, reversing, interrupted motion and others) repeatedly and examine the smoothness and the certainty of operation.	Knife holding stand and table of veneer slicer Head stock of carriage Feed of automatic planing and moulding machine
	Operation of changing feed speed	1-22	Change the feed speed, and examine the smoothness of operation and the certainty of indication.	Feed speed of table of veneer knife grinder Feed speed of rip saw or automatic planing and moulding machine Rotating speed of feed roller of band saw machine
	Operation of changing feed	1-23	Change the feed, and examine the smoothness of operation and the certainty of indication.	Feed of plane stock of veneer lathe Set work amount of carriage
	Operation of changing in-feed speed	1-24	Change the in-feed speed, and examine the smoothness of operation and certainty of indication.	Mechanical in-feed of veneer knife grinder
	Operation of automatic reversing of feed	1-25	Examine the smoothness and the certainty of positioning and action of automatic reversing device.	Feed of plane stock of veneer lathe Running feed of lathe charger Table feed of knife grinder
	Operation of automatic stopping device	1-26	Examine the smoothness and the certainty of positioning and action of automatic stopping device.	Vertical feed of table of veneer slicer Automatic stopping device for carriage head stock
	Manual operation of feed	1-27	Examine the smoothness and the uniformity of motion by manual operation.	Doctor roll of glue spreader Vertical movement of spindle of wood borer Ruler of table band saw

Item		No.	Testing method	Typical examples of application (Reference)
Adjustment motion of positioning	Operation of engaging and disengaging the devices for mechanical feed and rapid traverse	1-31	Examine the smoothness and the certainty of positioning and operation of engaging and disengaging the devices for mechanical feed and rapid traverse.	Feed mechanism for set work mechanism of veneer lathe
	Operation of automatic positioning device	1-32	Examine the certainty of setting of position to be commanded and operation of automatic stopping device for positioning of elements in performing mechanical feed.	Positioning of saw blade of double sizer Stopping device
	Operation of position adjustment and clamping	1-33	Examine the smoothness and uniformity of movement by mechanical or manual operation. In addition, clamp the element at a position of its travel and examine the certainty of its operation.	Wood clamping device for logs in veneer slicer Pivoting and vertical movement of arm of radial saw Operation of the ruler of table band saw
Mounting and diomounting	Holding and releasing of cutting tool	1-41	Examine the certainty and smoothness of holding and releasing of cutting tool.	Circular saw of double sizer Knives of planing and moulding machine Router bit
	Loading and unloading of workpiece	1-42	Examine the certainty and smoothness of loading and unloading of workpiece.	Loading of workpiece on veneer lathe, hollow-chisel mortiser and dovetail machine
Auxiliary equipment	Electrical equipment	1-51	Test the insulation of electrical equipment before and after the running test.	Electrical equipment of band saw machine, planing and moulding machine and veneer lathe
	Safety device	1-52	Test the certainty of safety device for operator and the protection of machine against damage.	Front and back moving device and stopping device of plane stock of veneer lathe
	Lubricating device	1-53	Test the certainty of functioning such as oil tightness and correct distribution of oil.	Automatic oil-feed device
	Hydraulic system	1-54	Test the certainty of functioning such as oil tightness and pressure regulation.	Hydraulic system of band saw machine, hot press, veneer lathe, etc.
	Pneumatic system	1-55	Test the certainty of functioning such as air tightness and pressure regulation.	Pneumatic system of band saw machine, veneer lathe and veneer clipper
	Attachment	1-56	Test the certainty of functioning of attachment.	
	Other equipment	1-57	Test the certainty of functioning of equipment.	Dust collector for band saw machine

3.3 No-Load Running Test Methods The wood working machine shall be run under the predetermined no-load condition and shall be tested for running conditions ([2]), variation of temperature and required electric power. Methods of expressing test results, test items and their measuring methods are as follows:

Note ([2]) Running conditions mean speed, and number and length of strokes, and their deviations from indications, and the conditions of vibration, noise, lubrication, airtightness, oil tightness, etc.

(1) Method of Expressing Test Results Test results shall be expressed in terms of running conditions, temperature, required electric power and others.

(2) Test Items and their Measuring Methods

Item		No.	Measuring instrument	Measuring method	Typical examples of application (Reference)
Spindle speed		2-11	Speedometer Stroboscope	Measure spindle rotation speed throughout each step of speed.	Spindle of band saw machine Spindle of veneer lathe router, and moulding machine
Feed		2-21	Speedometer Call meter and stopwatch	Measure feed rate throughout each step of feeds.	Rotation of feed roller of automatic roller band saw machine Caterpillar of rip saw
Tempera-ture	Temperature of bearing	2-31	Etched-stem liquid-in-glass thermometer Thermocouple thermometer Resistance thermometer	Rotate the spindle at speeds of lowest to highest throughout each step and then measure the temperature of bearing while running at the highest.	Main spindle bearing of circular saw, and planing and moulding machine Bearing for saw spindle of band saw machine Bearing for wheel spindle of knife grinder
	Temperature of hydraulic fluid	2-32		Measure the temperature of hydraulic fluid.	Hydraulic fluid of hydraulic carriage
	Temperature of spindle head, gear box, etc.	2-33		Measure the temperature of spindle head, gear box, etc.	Gear box of automatic planing and moulding machine Gear box of slicer, or veneer lathe
	Room temperature	2-34		Measure the room temperature around wood working machine.	

Item	No.	Measuring instrument	Measuring method	Typical examples of application (Reference)
Required electric power	2-41	Watt meter { Voltmeter Ammeter and power-factor meter	Measure the required electric power (watt, volt and ampere) under given running conditions. At the end of running, measure the total power required at full running.	Carriage of band saw machine Circular cutter block of planing and moulding machine Main spindle of veneer lathe
Vibration	2-51	Vibration indicator, accelerometer	Sensory test, or JIS B 6003 shall be correspondingly applied.	
Noise	2-61	Sound level meter	Sensory test, or JIS B 6004 shall be correspondingly applied.	

3.4 Load Running Test Method The wood working machine shall be run under the loading conditions and then shall be tested for its running conditions ([3]) and required electric power. Methods of expressing test results, and test items and their measuring methods are as follows:

Note ([3]) Running conditions mean speed and number and length of strokes and their variation, and conditions of vibration, noise, lubrication, airtightness, oil tightness, etc.

(1) Methods of Expressing Test Results Test results shall be expressed in terms of running conditions and required electric power.

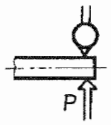
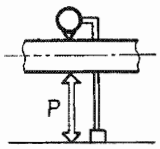
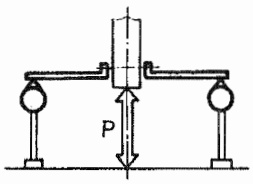
(2) Test Items and their Measuring Methods

Item		No.	Measuring instrument	Measuring method	Typical examples of application (Reference)
Capacity of machine	Power	3-11	Watt meter { Voltmeter Ammeter and power-factor meter	Change the load and measure power at each step of feed.	
Vibration		3-21	Vibration indicator Accelerometer	Sensory test or JIS B 6003 shall be correspondingly applied.	
Noise		3-31	Indicating sound level meter	Sensory test or JIS B 6004 shall be correspondingly applied.	
Condition of surface finish		3-41		Sensory test.	

3.5 Rigidity Test Methods In rigidity tests, the deformation of a machine shall be tested, by applying the load to the machine part the deformation of which is considered to affect significantly the working accuracy. The method of expressing test results, and test items and their measuring methods are as follows:

(1) Method of Expressing Test Results The results shall be expressed as the total displacement caused by elastic deformation and clearance of mechanism.

(2) Test Items and their Measuring Methods

Item	No.	Measuring instrument	Measuring method	Drawing	Typical examples of application (Reference)
Rigidity of spindle against bending	5-11	Test indicator and weighing instrument	Measure the displacement of spindle when the load (P) is applied to the spindle vertically.		Saw spindle of circular saw Spindles of veneer lathe and band saw sharpener
Resultant rigidity of spindle and table	5-21	Test indicator and weighing instrument	The load (P) is applied via table to spindle vertically or horizontally. Measure the relative displacements between spindle and table.	(1)  (2) 	Cutter block and table of automatic planing and moulding machine Spindle and table of multi-spindle wood borer Grinding drum and table of drum sander

4. Specifications of Static Accuracy Tests

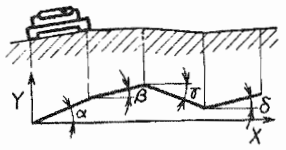
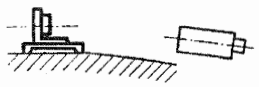
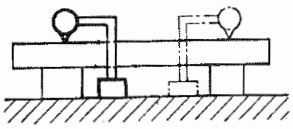
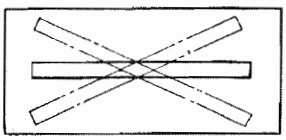
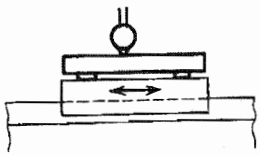
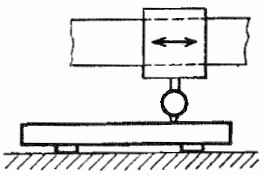
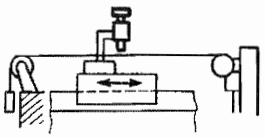
4.1 Objectives and Items of Static Accuracy Test Static accuracy tests are intended to check the accuracies of forms and motions of essential parts which compose a wood working machine and the assembling accuracies of units or components, especially, considered to affect working accuracy. These include straightness, circularity, cylindricity, parallelism, flatness, perpendicularity, run-out of rotating axis, axial movement of rotating axis, coaxiality, and lead accuracy of screw threads.

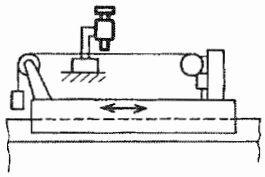
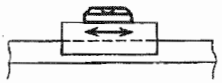
4.2 Straightness The definition of straightness and its expressing method, and test items and their measuring methods are as follows:

(1) Definition The degree of deviation from the geometrical straight line of the form of machine part or its motion supposed to be a straight line.

(2) Expressing Method The straightness shall be expressed as the difference of the maximum distance and the minimum distance between the measured line and the reference line, or the difference of the largest tangents and the smallest tangent of angles formed by measured lines with reference to the reference line. The distance shall be measured in normal direction to the reference line.

(3) Test Items and their Measuring Methods

Item	No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Straightness (of form) of machine component parts	6-11	Precision level, or auto-collimator	Take the horizontal line as reference. The maximum difference of readings taken at several positions.		Slide face of bed of veneer knife grinder Slide face of bed of numerically controlled router
			When it is required to know the precise form (of surface), it may be measured by chain rule as shown in the drawing.	 	
	6-12	Straightedge and test indicator	Take a straightedge as the reference line. Maximum difference of readings to straightedge.		Hot plate of hot press Peripheral surface of saw wheel of band saw machine
	6-13	Straightedge and feeler gauge	Take a straightedge as the reference line. Maximum clearance between the straightedge and an object to be measured.		Ruler face of hand planing and moulding machine Knife fitting face of veneer lathe Slide face of head block of carriage
Straightness of motion	6-21	Straightedge (fixed on moving part) and test indicator (fixed)	Take a straightedge as the reference line. The maximum difference of readings throughout the range of travel.		Reciprocating motion of moving rest of circular saw Motion of slicer knife holding stand
	6-22	Straightedge and test indicator (fixed on moving part)	Take a straightedge as the reference line. The maximum difference of readings throughout the range of travel.		Motion of knife holder of veneer lathe Front and back motion of circular saw spindle
	6-23	Steel wire Micrometer microscope (fixed on moving part)	Take a line joining two extremities of steel wire as the reference line. The maximum difference of readings throughout the range of travel.		Reciprocating motion of grinding-wheel hold of veneer knife grinder

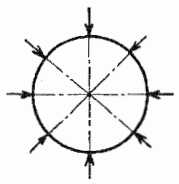
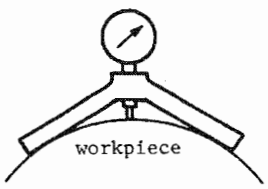
Item	No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Straightness of motion	6-24	Steel wire (fixed on moving part) and micrometer microscope	Take a line jointing two extremities of steel wire as the reference line. The maximum difference of readings throughout the range of travel.		
	6-25	Precision level (fixed on moving part)	Take the horizontal line as reference. The maximum difference of readings at several positions		Motion of saw hold stand of double sizer

4.3 Circularity The definition of circularity and its expressing method, and test items and their measuring methods are as follows:

(1) Definition The degree of deviation from the geometrical circle of the form of a machine part supposed to be circular.

(2) Expressing Method The circularity shall be expressed as the maximum difference of diameters or radii in a cross section.

(3) Test Items and their Measuring Method

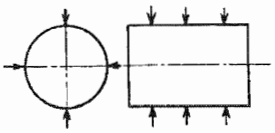
Item	No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Circularity of machine parts	7-11	Micrometer calliper for external measurement	Measure four diameters spaced at 45° angle. The maximum difference of readings of four diameters.		Doctor roll of glue spreader Feed roll of double sizer Main spindles of band saw machine and circular saw machine
	7-12	Straddle gauge of 60° to 120°	Measure radii at several positions. The maximum difference of readings of the radii at several positions.		Main spindle of circular saw machine Cutter block (circular) of planing and moulding machine

4.4 Cylindricity The definition of cylindricity and its expressing method, and test items and their measuring methods are as follows:

(1) Definition The degree of deviation from a geometrical cylinders of the form of a machine part supposed to be cylindrical.

(2) Expressing Method The cylindricity shall be expressed as the difference of the largest diameter and the smallest diameter measured on a plane including the cylinder axis.

(3) Test Items and their Measuring Method

Item	No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Cylindricity of machine part	8-11	Micrometer callipers for external measurement	Measure diameters of machine part on two planes involving the axis and perpendicular to each other. Required value is the larger one of the maximum differences of diameters measured on each plane. Positions to be measured are at least both ends ([4]) and central part of the cylindrical part in the axial direction.		Doctor roll of glue spreader Feed roll of double sizer

Note ([4]) Measurement on shear drop shall be avoided.

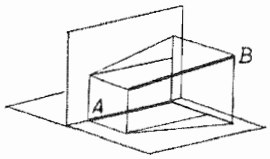
4.5 Parallelism The definition of parallelism and its expressing method, and test items and their measuring methods are as follows:

(1) Definition The degree of deviation from being geometrically parallel of the form of a machine part or its motion supposed to be parallel to the reference.

(2) Expressing Method

(a) For parallelism of two lines A and B, it shall be expressed as the maximum variation of distances between lines A and B on the basis of line A, or the maximum variation of tangent of angle for two lines A and B at the corresponding point, and the distance shall, as a rule, be measured in normal direction to the reference line.
In general, line B shall be projected onto two planes perpendicular to each other and including the reference line A, and measurement shall be made on both planes.

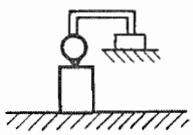
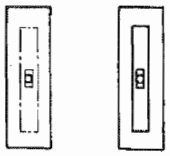
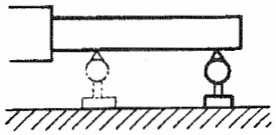
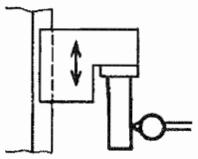
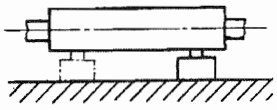
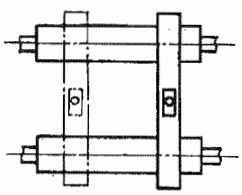
Parallelism

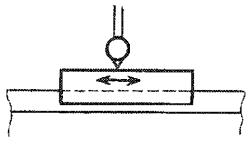
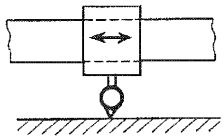
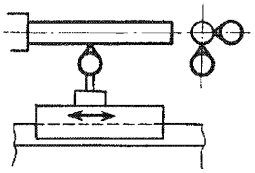
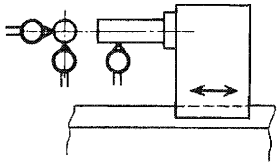
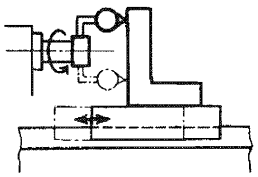
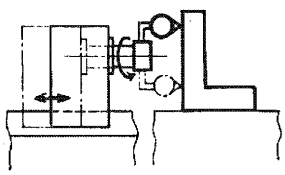


(b) For parallelism of line and plane, it shall be expressed as the maximum variation of their distances referred to each line or plane. The distance shall, as a rule, be measured in normal direction to the reference line or the reference plane.

(c) For parallelism of two planes, it shall be expressed as the maximum variation of distances of a plane from the other plane as a reference. The distance shall, as a rule, be measured in normal direction to the reference plane.

(3) Test Items and their Measuring Method

Item		No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Parallelism of machine component	Parallelism of two planes	9-11	Test indicator and end measure (may be used as auxiliary.)	The maximum difference of readings taken at several positions		Cross rail and table of copying chamfering machine and numerically controlled router
		9-12	Straightedge and precision level	The maximum difference of readings at several positions		Right and left-fixed slide faces of veneer lathe Right and left sliding faces of tool rest of veneer clipper
	Parallelism of axis and plane	9-21	Test indicator { Test bar and test indicator	The maximum difference of readings throughout the range of travel		Saw-holding down-face and main spindle of band saw sharpener Main axis of gang rip saw and top face of caterpillar
		9-22	Test indicator (fixed) { Test bar and test indicator (fixed)	The maximum difference of readings throughout the range of travel		Up and down movement of table, and main spindle of router Each plate of veneer jointer Up and down movement of clamping table and spindle
		9-23	End measure and feeler gauge	The maximum difference of readings throughout the range of travel		Main spindle and surface plate of automatic planing and moulding machine
	Parallelism of two axes	9-31	Straightedge and precision level	The maximum difference of readings throughout the range of travel		Rollers of table of automatic roller band saw machine Feed rollers of double sizer

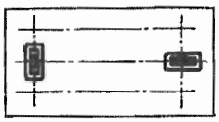
Item		No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Parallelism of motion	Parallelism of motion and plane	9-41	Test indicator (fixed)	The maximum difference of readings throughout the range of travel		Motion of tool rest of veneer slicer Motion of table of wood milling machine Motion of table of tenoning machine and double sizer
		9-42	Test indicator (fixed on a moving part)	The maximum difference of readings throughout the range of travel		Main spindle of veneer lathe and tool fitting face of tool rest Vibration stop of band saw machine and band sawing face Cross rail of numerically controlled router
	Parallelism of motion and axis	9-51	Test bar and test indicator (fixed on a moving part)	The maximum difference of readings throughout the range of travel		Tool rest and main spindle of wood-working lathe
		9-52	Test bar and test indicator (fixed)	The maximum difference of readings throughout the range of travel		Tail stock and bed of wood lathe
		9-53	Straightedge or square surface plate (fixed on a moving part) and test indicator	The maximum difference of readings throughout the range of travel		Tool rest and main spindle of wood lathe
		9-54	Straightedge or square surface plate and test indicator (fixed on a moving part)	The maximum difference of readings throughout the range of travel		Saw spindle and top face of table of tenoning machine

4.6 Flatness The definition of flatness and its expressing method, and test items and their measuring method are as follows:

(1) Definition The degree of deviation from the geometrical plane of a surface of a machine part supposed to be flat.

(2) Expressing Method The flatness shall be expressed as straightness on a plane in two directions perpendicular to each other.

(3) Test Items and their Measuring Method

Item	No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Flatness of machine part	10-11	Precision level	Take a horizontal plane as the reference. The maximum difference of readings taken at several points.		Table of table band saw and planing and moulding machine Top surface of surface plate or movable surface plate of cold press

4.7 Squareness The definition of squareness and its expressing method, and test items and their measuring methods are as follows:

(1) Definition The degree of deviation from the geometrical square of the form of a machine part or its motion supposed to be square.

(2) Expressing Method

(a) For two lines A and B, the squareness shall be expressed as parallelism of line B to the reference plane perpendicular to line A.

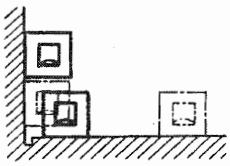
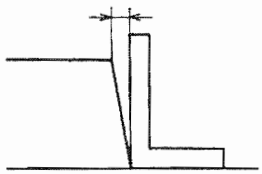
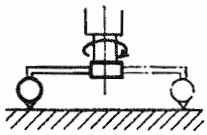
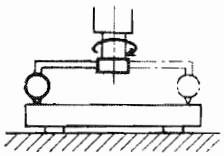
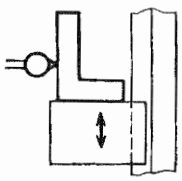
(b) For a line and a plane, the squareness shall be expressed as either one of the following:

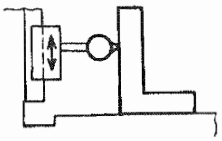
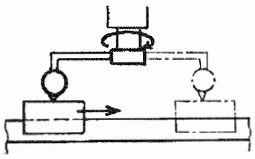
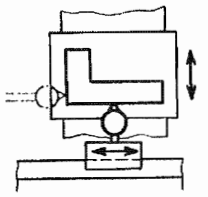
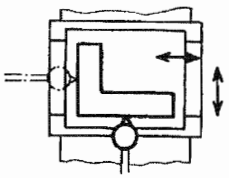
(i) Parallelism of plane to the reference plane perpendicular to a line.

(ii) Parallelism of a line to the reference line perpendicular to a plane.

(c) For two planes, the squareness shall be expressed as parallelism of a plane to the reference line perpendicular to the other plane.

(3) Test Items and their Measuring Method

Item		No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Squareness of machine part	Perpendicularity of one plane to the other	11-11	Box precision level	The maximum difference of readings at several points		Head block of carriage Sliding face of bed of veneer jointer
		11-12	Straightedge and feeler gauge	The maximum value between a subject to be measured and the square		Head block of carriage Table of circular saw machine or hollow chisel mortiser and square
	Perpendicularity of axis to plane	11-21	Test indicator { Test bar and test indicator	Difference of readings in each of the two positions at 180°		Main spindle of circular saw machine and square surface Main spindle and top surface of table of wood borer and router
		11-22	Test indicator	Difference of readings in each of the two positions at 180°		Between top face of table and vertical spindle of vertical tenoning machine
Perpendicularity of motion	Perpendicularity of motion to plane	11-31	Straightedge or square surface plate (fixed on a moving part) and test indicator (fixed)	The maximum difference of readings throughout the range of travel		Vibration stop of band saw machine Between up and down movement of main spindle of hollow chisel mortiser and table surface

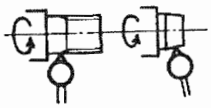
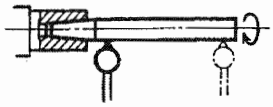
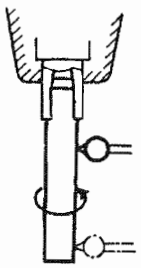
Item		No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Perpendicularity of motion	Perpendicularity of motion to plane	11-32	Straightedge or square surface plate and test indicator (fixed on a moving part)	The maximum difference of readings throughout the range of travel		Between movements of saw spindle head of double sizers and top face of chain case Between up-and-down movement of main spindle of hollow chisel mortiser and table surface
	Perpendicularity of motion to axis	11-41	Square surface plate (fixed on a moving part) and test indicator	Difference of readings in each of the two positions at 180°		Between motions of main spindle of rip saw and top face of caterpillar
	Perpendicularity of one motion to the other	11-51	Straightedge (fixed on a moving part) and test indicators (one fixed and the other fixed on a moving part)	The maximum difference of readings throughout the range of travel		Between movements of movable tables of hollow chisel mortiser
		11-52	Straightedge (fixed on a moving part) and test indicator (fixed)	The maximum difference of readings throughout the range of travel		Between movements of movable tables of hollow chisel mortiser

4.8 Run-out of Rotating Axis The definition of run-out of rotating axis and its expressing method, and test items and their measuring methods are as follows:

(1) Definition Runout of the rotating axis means radial throw of the axis of a rotating cylindrical machine part.

(2) Expressing Method The run-out shall be expressed as the maximum deviation of radial throw of revolving surface to be tested during several rotations while the spindle is slowly rotated. The resultant measured value shall be deemed as the compound of the surface abnormalities.

(3) Test Items and Measuring Method

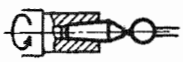
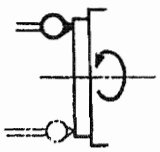
Item		No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Run-out of external surface	Run-out of external surface of machine part	12-11	Test indicator (fixed)	The maximum difference of readings during rotation		Spindle of circular saw machine and veneer lathe Wheel spindle of veneer knife grinder
Run-out of internal surface	Run-out of internal surface	12-21	Test bar and test indicator (fixed)	The maximum difference of readings during rotation		Main spindle of wood milling machine
	Run-out of internal surface of parts fitted to the spindle	12-31	Test bar and test indicator (fixed)	The maximum difference of readings during rotation		Chuck of router

4.9 Periodical Axial Slip The definition of periodical axial slip and its expressing method, and test items and their measuring methods are as follows:

(1) Definition Extent of periodical axial movement of a point on the rotation axis during its rotation.

(2) Expressing Method The movement shall be expressed as the maximum axial slip of the axis when the axis is rotated slowly. In this case, it is preferable to apply a required force to the axis to eliminate the play in the direction of normal working thrust. When the measurement is made on the end surface, it should be understood that the measured value includes irregularities of the end surface.

(3) Test Items and their Measuring Method

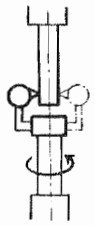
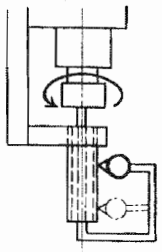
Item	No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Axial slip of a rotating part	13-11	Test bar and test indicator (fixed)	The maximum difference of readings during rotation		Saw spindle of double sizer Wheel spindle of veneer knife grinder
Axial slip of a plane perpendicular to an axis during its rotating around the axis	13-21	Test indicator (fixed)	The maximum difference of readings during rotation. Take the larger of readings for the two positions at 180°.		Saw spindle of double sizer Wheel spindle of veneer knife grinder

4.10 Coaxiality The definition of coaxiality and its expressing method, and test items and their measuring methods are as follows:

(1) Definition The degree of deviation from being coincident of two axes of cylindrical parts which are aligned so as to have a common axis.

(2) Expressing Method The coaxiality shall be expressed as the distance between the centers of two circles projected on a cross section perpendicular to the axis of a cylindrical part.

(3) Test Items and their Measuring Methods

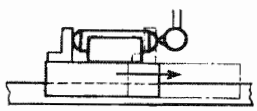
Item	No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Alignment of two axes of cylindrical parts	14-11	Test indicator and test bar	1/2 of the maximum difference of readings when test indicator is rotated around an axis		Between center pin and spindle of router
Coincidence of axes of internal and external cylinders	14-21	Test bar and test indicator	1/2 of the maximum difference of readings during rotation		Between main spindle and chisel holder of hollow chisel mortiser

4.11 Accuracy of Lead of Screw Thread The definition of the accuracy of lead of screw thread and its expression method, and test items and their measuring methods are as follows:

(1) Definitions The degree of deviation from the reference dimension of an axial dimension of screw threads or rectilinear displacement generated by lead of screw of a machine component.

(2) Expressing Method The lead accuracy shall be expressed as the difference of an axial distance between two points on a helix or a value of displacement generated by lead of screw of a machine part from the theoretical distance.

(3) Test Items and their Measuring Methods

Item	No.	Measuring instrument	Measuring method and indication of tolerance	Drawing	Typical examples of application (Reference)
Cumulative error	15-11	End measure and test indicator (fixed)	The maximum difference of readings throughout the range of travel		Set works of twin band saw machine Positioning for width of double sizer Positioning of numerical controlled router

5. Specifications of Dynamic Accuracy Tests

5.1 Objectives and Items of Dynamic Accuracy Test The dynamic accuracy test is intended to check such dynamic accuracies of motions of essential parts composing wood working machines, as are considered to affect working accuracy. The test shall be performed for the following items:

5.2 Dynamic Balance The definition of dynamic balance and its expressing method, and the test item and its measuring method are as follows:

(1) Definition The degree of deviation from the ideal rotation of a high-speed rotation of a machine part.

(2) Expressing Method The eccentricity $\varepsilon(\mu)$ of balancing plane to be corrected of the high-speed rotating body shall be measured. Dynamic balance is expressed as the value (mm/s: balance quality) of the measured value multiplied by the maximum working angular velocity $[\omega(\mathrm{rad/s})]$ of the rotating body divided by 1000.

$$\text{Balance quality} = \frac{\varepsilon\omega}{1000}$$

(3) Test Items and their Measuring Methods The mass of the rotating body (M) and the degree of unbalance (mr) shall be measured. Eccentricity (ε) of the balancing plane is calculated by the following equations:

Item	No.	Measuring instrument	Measuring method for ε	Drawing	Typical examples of application (Reference)
Dynamic balance of machine part	16-11	Dynamic balancing machine	In the case of two plane balancing $\varepsilon_L=\frac{(mr)_L}{\frac{M}{2}}$ $\varepsilon_R=\frac{(mr)_R}{\frac{M}{2}}$	—	Circular cutter block and drum of drum sander
			In the case of one plane balancing $\varepsilon=\frac{(mr)}{M}$		Saw wheel of band saw machine

6. Specifications of Working Accuracy Tests

6.1 Objectives and Items of Working Accuracy Test Working accuracy tests are intended to check the accuracy of workpieces already machined. They include the check of straightness, parallelism, squareness, accuracy of thickness and size variation.

6.2 Straightness The definition of straightness and its expressing method, and its measuring methods are as follows:

(1) Definition The degree of deviation from the geometrical straight line of a machined part supposed to be a straight line.

(2) Expressing Method The straightness shall be expressed as the maximum difference of distances between the measured line and the reference line. The distance, as a rule, shall be measured in normal direction to the reference line.

(3) Measuring Method Either one of the methods described below shall be used:

(a) Machine a test piece ([5]), apply a straightedge on the machined surface, and measure the clearance. The required value shall be the maximum value of clearance.

(b) Machine two test pieces ([5]) under the same working conditions, then place the two pieces in contact with each other, worked face to worked face, and measure the clearance between the two faces. One half of the maximum value of clearance shall be taken as the measured value.

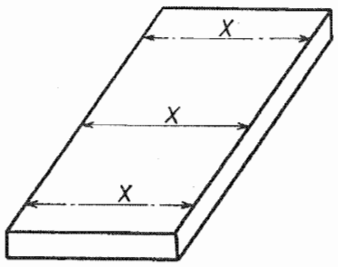
6.3 Parallelism The definition of parallelism, and its expressing method, and its measuring method are as follows:

(1) Definition The degree of deviation from being geometrically. parallel to the reference of the form of a machined part.

(2) Expressing Method As for parallelism of two planes A and B, it shall be expressed as the maximum variation of distances of a plane A from the other plane B as a reference. The distance shall, as a rule, be measured in normal direction to the reference plane.

(3) Measuring Method Machine a test piece ([5]) and measure the distance between two opposite faces at least at three positions, i.e., the middle position and both ends. The required value shall be the maximum deviation of the distances.

Figure



6.4 Perpendicularity The definition of perpendicularity, and its expressing method, and its measuring methods are as follows:

(1) Definition The degree of deviation from being perpendicular geometrically of an angle formed by two machined planes.

(2) Expressing Method The parallelism shall be expressed as the parallelism of a plane to the reference line perpendicular to the other plane.

(3) Measuring Method Either one of the following methods shall be used.

(a) Machine a piece of test wood ([5]), place a side of a square and a side of the test wood on a reference plane, and measure the differences between the other side of the test wood ([5]) and the other side of the square. The maximum difference is taken as the measured value (Fig. 1).

(b) Machine two pieces of test wood ([5]) under the same conditions, apply the corresponding sides of the test wood pieces on a reference plane, and measure the clearance on the plane between the machined sides in contact with each other. One half of the maximum clearance is taken as the measured value (Fig. 2).

Fig. 1

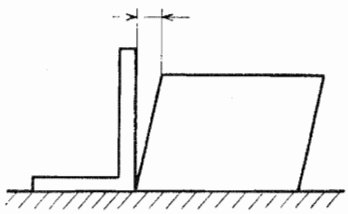
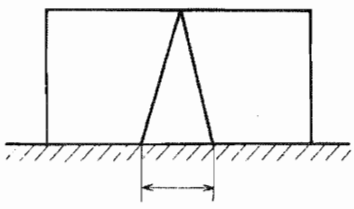


Fig. 2



6.5 Thickness Accuracy The definition of thickness accuracy and its expressing method, and its measuring method are as follows:

(1) Definition The degree of variation of the thickness in a machined work-piece.

(2) Expressing Method The accuracy shall be expressed as the difference between the maximum and minimum values measured.

(3) Measuring Method Measure thickness at least at the middle and both end positions ([6]). The maximum difference is taken as the measured value.

Notes ([5]) The test wood shall be of good quality.

([6]) Measurement shall be made on the positions free from shear drop, flash, etc.

6.6 Size Variation The definition of size variation and its expressing and measuring methods are as follows:

(1) Definition The degree of variation of forms or dimensions of workpieces which are machined to be of an identical shape.

(2) Expressing Method The size variation shall be expressed as the difference between the maximum and the minimum of measured values ([7]) for the measurement items made on all machined workpieces.

Note ([7]) This may be the mean of measured values for the measurement item made on one kind of workpiece, if required.

Appendix

1. Measuring Instruments for Running Tests

1. Measurement of Insulation Resistance

Use an insulation resistance tester specified in JIS C 1301.

2. Measurement of Linear Velocity

Use a test indicator and a stopwatch, a call meter and a stopwatch or tachometer.

3. Measurement of Number of Revolutions

Use a tachometer specified in JIS B 7521 or a stroboscope.

4. Measurement of Temperature

Use an etched-stem liquid-in-glass thermometer specified in JIS B 7411, a thermoelectric thermometer in JIS C 1601, or a resistance thermometer in JIS C 1603.

5. Measurement of Electric Power

Use a wattmeter specified in JIS C 1102, or a voltmeter, an ammeter, and a power factor meter specified in JIS C 1102.

6. Measurement of Vibration

Use a vibrometer specified in JIS B 6003.

7. Measurement of Noise

Use a sound-level meter specified in JIS B 6004.

8. Measurement of Rigidity

Use a lever, a weight and a test indicator, or a load meter and a test indicator.

9. Others

Use a magnifier, water content meter, etc.

2. Accuracy of Measuring Instruments for Testing of Accuracy

1. The permissible deviation of a test indicator shall be within 0.003 mm over the working range.

When a dial gauge is used, it shall be of Grade 1 in JIS B 7503 or one specified in JIS B 7509.

2. The tolerance on straightness and cylindricity of a test bar shall be $\left(0.001+\frac{L}{200000}\right)$ mm, where L represents the effective length (mm) of the cylindrical part.

3. The tolerance on coaxiality of the cylindrical part and the tapered part of a test bar shall be 0.004 mm.

4. The tolerance on coaxiality of the center hole and the cylindrical part of a test bar shall be 0.004 mm.

5. The diameter of a test bar shall be selected so that the deflection due to its own weight will not cause a measuring error.

6. The tolerance on the straightness of a straightedge and a square surface plate shall be $\left(0.001+\frac{L}{500000}\right)$ mm, where L represents the effective length (mm). The straightedge shall be longer than the length to be measured.

7. The diameter of steel wire used for the measurement of straightness shall be not more than 0.16 mm and the straightness of a straightedge shall be applied correspondingly to that of taut steel wire.

Further, when deflection due to weight of wire itself is considered to cause a measuring error, this method shall not be used.

8. The permissible deviation of readings of a micrometer microscope shall be ± 0.002 mm. nm.

9. The dimensional accuracy of Grade B in JIS B 7506 shall be applied correspondingly to that of an end measure.

10. The tolerance on the squareness of a square and a square surface plate shall be $\pm\left(0.002+\frac{L}{200000}\right)$ mm in a position on the side L mm distant from the vertex.

11. A feeler gauge specified in JIS B 7524 shall be used.

12. A precision level of Class 1 or Class 2 specified in JIS B 7510 or JIS B 7511 shall be used.

Applicable Standards:

JIS B 6003-Methods of Vibration Testing for Machine Tools

JIS B 6004-Method of Sound Level Measurement for Machine Tools

JIS B 7411-Etched-Stem Liquid-in-Glass Thermometers, Total Immersion Type

JIS B 7503-Dial Gauges Reading in 0.01 mm

JIS B 7506-Gauge Blocks

JIS B 7509-Dial Gauges Reading in 0.001 mm

JIS B 7510-Precision Square Levels

JIS B 7511-Precision Levels

JIS B 7521-Portable Chronometric Tachometers

JIS B 7524-Feeler Gauges

JIS C 1102-Electrical Indicating Instruments

JIS C 1301-Insulation Resistance Testers (Magneto Generator Operated)

JIS C 1601-Indicating Thermoelectric Thermometers

JIS C 1603-Indicating Resistance Thermometers

Reference Standards:

JIS B 7502-Micrometer Callipers for External Measurement

JIS B 7507-Vernier Callipers

JIS B 7512-Steel Tape Measures

JIS B 7513-Precision Surface Plates

JIS B 7514-Steel Straightedges

JIS B 7526-Squares

JIS G 3521-Hard Drawn Steel Wires

JIS G 3522-Piano Wire

JIS Z 8203-SI Units and the Use of their Multiples and of Certain other Units

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